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ABSTRACT

This paper utilizes the characteristics of model science instruction to identify exemplary Internet-based science collaborations. The filter for attaining "exemplary" status was based on state and national standards-generating initiatives and the corresponding implications for appropriate student activity in science classrooms. Twenty examples of online collaboration are identified, described, and used as models that contain the basic components of effective online science collaboration. These models are separated into the following categories: (1) observation and sampling of wildlife (self-collected data); (2) observation and sampling of wildlife (scientist-collected data); (3) observation and sampling of self-characteristics; (4) sampling and analysis of environmental data; (5) resource awareness and consumption; (6) content-related, participant-dependent calculation; and (7) problem solving and engineering. The models also serve to highlight ancillary features that make online collaborative investigations even more effective. (Author/MES)

Top 20 Collaborative Internet-based Science Projects of 1998: Characteristics and Comparisons to Exemplary Science Instruction

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Top 20 Collaborative Internet-based Science Projects of 1998: Characteristics and Comparisons to Exemplary Science Instruction

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Abstract: This paper utilizes the characteristics of model science instruction to identify exemplary Internet-based science collaborations. The filter for attaining "exemplary" status was based on state and national standards-generating initiatives and the corresponding implications for appropriate student activity in science classrooms. Twenty examples of on-line collaboration are identified, described and used as models that contain the basic components of effective on-line science collaboration. These models also serve to highlight ancillary features that make on-line collaborative investigations even more effective.

Introduction

Using the Internet as a tool to facilitate collaboration between schools for data-sharing investigations is a fairly recent phenomenon. During on-line collaborations, teachers and students complete science-related investigations using a process common to their on-line partners. The specifics and mechanics of this process greatly varies. Yet, the common core of the investigation and process contains similarities to exemplary science instruction.

Exemplary Science Instruction

First and foremost, science instruction, whether Internet-based or not, should provide opportunities for students to develop toward well-defined science goals and standards. These standards provide a vision and indicators for those involved in producing exemplary science instruction. National efforts such as Project 2061's Science For All Americans (1989) and Benchmarks for Scientific Literacy (1993), The National Science Standards (1996), and compatible, but, more local efforts, such as Wisconsin's Model Academic Standards for Science (1998) provide guidance and examples for science programs and teachers who in turn, provide science experiences to children. These efforts to define goals have made specific content objectives less elusive, and have aided to assist science educators to reach some consensus concerning general goals. In general, science teachers want science students to (Berg & Clough, 1991):

- Perceive science as a set of meaningful, interrelated concepts, rather than mastery of many insignificant isolated facts;
- Convey positive attitudes about science indicating that science is meaningful and useful to them;
- Convey an understanding of the nature of science;
- Identify and solve problems effectively;
- Understand the connection of science to their community and personal lives;
- Demonstrate an awareness of the importance of science in many careers;
- Work cooperatively with other students as well as independently;
- Demonstrate constructive creativity and curiosity;
- Access, retrieve, and use the existing body of scientific knowledge in the process of investigating science-related phenomena;
- Communicate effectively;
- Set goals, make decisions, and self evaluate, and;
- Demonstrate logical as well as critical thinking.

During this enterprise, students should:

- Actively construct knowledge from what they observe and experience during the science activities;
- Ask questions, test ideas, interpret data, gather information, challenge ideas, physically and mentally manipulate objects and experiences;
- Actively participate in science;
- Identify problems as well as solve problems;
- Make decisions related to their science study and their science activities;
- View the classroom as a place to *begin* science-related inquiries; understanding that in-class experiences can be transferred to investigations *outside* of the classroom;
- View science as having intricate connections to their daily lives;
- Develop oral and written communication skills to display understandings of the fundamentals of science; and
- Use their scientific knowledge.

It is through this lens that we examined Internet-based collaborations to determine which might be used as models of exemplary Internet-based science instruction.

Exemplary Collaborative Inquiry

For this paper, collaborative inquiry is defined as one classroom interacting with one or more classrooms based on a science-related investigation or topic. Collaborative inquiry, while facilitating and including many of the goals listed above, may be accomplished several different ways. For example, while much can be accomplished using only e-mail and attachments, the advent of the web with graphics, sound, and forms to facilitate instruction has made the process of displaying information and interacting with others much easier and less technically demanding. Many projects are now based from web home pages and contain more user - friendly methods of sharing data via forms on the web page. Participants simply need to input data directly into the form, as opposed to sending additional e-mail attachments. The frustration of encoding and uncoding formats properly has been eliminated through the development of data forms which are inserted directly into the web site text. In addition, project proposers and organizers are somewhat savy to the necessary ingredients of a successful collaborative project. Their invitation to participate delineates the key foundational components needed to ensure a successful collaboration. The introduction tends to incorporate most of Harris' (1995) suggestions - the what, why, when and how so that potential collaborators know what is expected of them, as well as the potential benefits of joining the project. In addition, most home pages provide mechanisms for:

- project registration (via e-mail or web-based form)
- sending the collected data and receiving other participant's data (e-mail or web-site form, automatically re-sent to participants via e-mail reflectors, or stored on web site for participants to analyze).

In addition, web project pages might offer other necessary or sometimes ancillary components such as:

- Resource/related links
- A description of the experiment via text, movies or photos
- Talk to a scientist
- Archived data from past years investigations
- Real time images
- Project activities (classroom activities that extend the investigation)
- Student's projects such as artwork, writing, reports, publications
- Teacher's manual containing background information plus connections to science education standards
- Student-student or teacher-teacher interaction area: might be listserv, listserv archives, or a forum area
- Participant list with e-mail addresses
- Project-related news and announcements

While few, if any, of the projects selected contain all of the mechanisms and supporting features listed above, the projects highlighted in this paper represent collaborations that have great potential for appropriate science instruction due to both the similarity to exemplary science and the superior project planning and manner in which the project is supported, processed, and assisted by using the Internet.

Categories and Model Collaboration Examples

For the purposes of this paper, the model collaborative Internet-based science investigations located were separated into the following categories:

1. Observation and sampling of wildlife (self-collected data)
2. Observation and sampling of wildlife (scientist-collected data)
3. Observation and sampling of self-characteristics
4. Sampling and analysis of environmental data
5. Resource awareness and consumption
6. Content-related, participant-dependent calculations
7. Problem solving and engineering

While the categories are not entirely discrete, they serve to help delineate some aspects of participation or focus of the investigation. What follows is a listing of the Internet-based projects that we offer as model or exemplary projects.

Wildlife Observation/Self Collected

Bird Watch at Feeders: http://earth.simmons.edu/birdwatch_protocol.html
Enables students to study the various migration tendencies and behaviors of birds. An inquiry based learning experience correlated with the arrival of different species of birds. Integration of disciplines such as mathematics, geography and industrial technology.

The Vernal Pool: http://earth.simmons.edu/vernal/pool/vernal_1.htm
Students collect data while investigating plant and animal species that inhabit an actual vernal pool. Participants post interesting findings on the Vernal Pool listserv.

Road Kill 98 Dr. Splatt: http://earth.simmons.edu/roadkill/rk_protocol.html
Students predict animal species which are most often killed by motor vehicles. Discussions of various habitats as well as the ecological importance of wildlife are explored. Estimation, mapping and graphing skills are required of the students.

Plants – Ethnobotany: http://earth.simmons.edu/plants/plants_protocol.html
A monitoring project which enables students to discover learning about plants from a nontraditional perspective. Students gather biochemical and genetic characteristics of plants in an attempt to either confirm or deny existing information about the plant. Nutrition, bio-chemistry, conservation, and multicultural studies are easily incorporated into this project.

View Nesting Birds: http://www.pitt.edu/~dziadosz/
This web site contains many sites from around the world that provide live video and/or update photographs of a pair of nesting birds. Some birds are tracked by satellite as they migrate from their nesting area.

Wildlife Observations/Scientist Collected

Biological Timing Online Science Experiment: http://www.cbt.virginia.edu/Olh/
Students make hypothesis about the behaviors of hamsters. Live images and actual experiment results are shared with other scientists from around the world.

Journey North Tulips: http://www.learner.org/jnorth/fall1998/tulip/index.html
International science project in which students will predict the "official" arrival of spring based upon the emergence and blossoming of tulips. Students design flowerbeds according to standards set by the project. The arrival of the tulips are compared and contrasted with other student projects throughout the world

Self-Characteristics

Genetics MiniUnit: http://www.netlabs.net/hp/ebend/genetics.html
Organized by Beers Street Middle School, students compare and contrast similarities/differences among both human and plant species through the exploration of genetics. In addition, students utilize online data sharing techniques to explore the diversity of the human species.

Environmental Data

Acid Rain: http://earth.simmons.edu/acidrain/acidrain.html
"The purpose of this project is to get students involved in measuring the pH of precipitation and to use this as a means of researching, discussing, and analyzing the complex issues of acidified precipitation and atmospheric pollution..."

Salt Track - Road Salt in Watershed: http://earth.simmons.edu/salttrack/intro.html
This monitoring project will show the results of chemical treatment for highways in winter. Early baselines of salt content will be established to provide students and teachers with an opportunity to observe the movement of a potential contaminate in surface and groundwater systems. Doing so will introduce students to the dynamics of watershed, water recycling, and ecosystem contamination. In addition, students will use concentrations of Sodium Chloride in experimenting with various "crop" plants, and observe the impacts of salination due to irrigation with groundwater supplies. This will also introduce students to the sensitivity of organisms in marine and freshwater systems to changes in salinity levels.

Ozone Monitoring Project: http://earth.simmons.edu/ozone/ozone_protocol.html
The Ozone project uses the EcoBadge® for determining local levels of ozone in ppb. "Applicable to K-12 students in all disciplines and teachers and students with all levels of technological ability. Entry level project participation involves the basic monitoring of classroom ozone levels. Exploratory level project participation involves additional monitoring of ozone levels outside of the classroom, and more sophisticated manipulation and analysis of data."

Global Water Sampling Project: http://k12science.stevens-tech.edu/curriculum/waterproj/index.html
A project that teams up students from around the world to test and compare the water quality of rivers, streams, lakes or ponds with other fresh water sources around the world. Students analyzed data to look for relationships and trends among the data collected by all project participants.

Dare to Share the Air - School Building and Air Quality: http://www.eduplace.com/projects/air.html
Students determine the effect of building age on air quality using school sites as the target buildings. The Environmental Protection Agency sponsors the project by designing the survey the students will use to standardize the project. Students will send the data to other student participants via a web page designed by the participants.

Resource Awareness/Consumption

Drinking Water/Wastewater Treatment: http://earth.simmons.edu/watershed/water_quality.html
Students perform basic chemical tests on environmental surface waters (both fresh and salt) to determine water quality. Water Quality Testing includes the following tests: temperature, pH, dissolved oxygen and biochemical oxygen demand, nitrates, turbidity of dissolved solids, as well as total coliform bacteria count. Water conservation and water pollution issues are also addressed.

Out of the Bin: http://archives.gsn.org/feb98/0006.html
Encourages young people to think and learn about improving their community's use of resources. Students explore ways in which resources can be re-used rather than thrown away in their own community. They will learn from other communities around the world about new ways in which their community might use resources more efficiently.

Content-Related, Participant-Dependent Calculations

Shoot for the Moon: http://ihnet.esuhsd.org/staff/dimasd/moon.html
Students use a parallax to determine distances to far away objects such as the moon. Students utilize geometry and/or trigonometry and mathematical formulas to determine distances. Internet searches as well as collaboration with other students for scientific data is required.

Boil, Boil, Toil and Trouble: The International Boiling Point Project:
http://k12science.stevens-tech.edu/curriculum/boilproj/index.html
Students discover what specific factors (room temperature, elevation, volume of water, heating device) have the greatest effect on boiling point. Standardized instructions and a web-based form to insert data allows students to compare their results with other students participating in the project.

Worldwide Eratosthenes Experiment: http://www.eduplace.com/projects/eratos.html
A simple equation is used to calculate the circumference of the Earth by measuring the shadow of the sun. Students share their results by entering their data onto the project experiment report form. Mapping skills such as knowledge of longitude and latitude are required of the students.

Problem Solving and Engineering

S.O.S - Send out Snow: http://archives.gsn.org/jan98/0027.html
Topic is based on how humans have solved the insulation problem throughout history. Specifically, students create and mail a snowball in the most efficient package to snow-less, southern California. Students who send the snowball receive an efficiency rating based on the amount of snowball surviving the journey. In addition, the students are sent a precipitation acidity printout for their school location from the students in southern California.

Fanciful Machines: http://archives.gsn.org/mar98/0014.html
This is a collaborative problem-solving project which involves middle school science classrooms. Students who participate in the contest create simple machines that perform routine tasks. Students build and test their designs. Classrooms communicate their progress via the Internet. Final products are videotaped and assessed by all participating classrooms.

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